International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 4
February 2018

# An Aspect of Pollution Issues in Bihar

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***Abstract:***

*Bihar has many dimensions of environmental and biodiversity degradation. It ranges from population growth and density, forest area degradation, urbanization, consumerism, poor waste disposal, lack of leadership, increased use of pesticide and insecticides in agriculture, vehicular pollution, use of biomass, and also radiation. The risky behavior of people such as non using alternate and environmental friendly methods of cooking, food processing, agriculture, horticulture, sanitation, heating and cooling devices*

***Keywords***

*Biodiversity, Degradation, Vehicular pollution, Insecticides, Urbanization, Horticulture, Sanitation*

## 1. INTRODUCTION

Major pollution world over may be described in terms of Air Pollution, Water Pollution, Noise Pollution, Soil/Land Pollution , Thermal Pollution, EMR Pollution, and Nuclear Pollution. They ultimately may contribute to several adverse atmospheric and environmental effects such as Acid Rain, Ozone Depletion, Global Warming, Climate Change, and Green House Effects. They may ultimately cause degradation of biodiversity, ecology, seasons, and ecosystem.

According to Bureau of Indian Standards, air pollution is the presence in the ambient air/atmosphere of substances generally resulting from the activities of man, in sufficient concentration present for a sufficient time and under circumstances, which interfere significantly with the comfort, health or welfare of persons or with full use of enjoyment of property. The WHO defines air pollution as limited to situations in which outdoor ambient atmosphere contains material air concentrations which are harmful to man and his environment. In other words, air pollution is, "The presence of one or more contaminants in the atmosphere which are injurious to human beings, plants and animals or which reasonably obstruct the comfortable enjoyment of life and property". Man inhales about 15 to 16 kg of air and breathes 22,000 times in a day (BPCB, 2015).

In India, there is a provision of National Ambient Air Quality Standards (NAAQS) having objectives such as indicating the levels of air quality necessary with an adequate margin of safety to protect the public health, vegetation and property; assisting in establishing priorities for abatement and control of pollutant level; providing uniform yardstick for assessing air quality at national level; and indicating the need and extent of monitoring program.

## 2. FINDINGS

### 2.1 Air pollution

High air pollution in Patna is posing a threat of not only respiratory trouble among the city residents but may also spawn cardiac problems. It is also likely to increase the mortality rate among heart disease patients.

According to a data of Bihar State Pollution Control Board (BSPCB), the air pollution situation in the city is really disturbing. The standard annual mean Respirable Suspended Particulate Matter (RSPM) of up to 60 microgram per cubic meter is not harmful, but the RSPM mean is almost triple that level now in Patna.

The board's data reveals that the annual average of RSPM recorded in the year 2006-2007 was 117. The figure touched 122 in 2007-2008 and in the year 2017-2018, RSPM rate grew to 222 microgram per cubic meter. BSPCB's study on health hazard of air pollution also revealed that with long exposure to RSPM, a person may develop diseases like bronchitis and pulmonary emphysema and thus, consequently, Cor Pulmonale.

A recent study correlating cardiac deaths and air pollution by the London School of Hygiene & Tropical Medicine, the largest study of its kind, found that an increase in the volume of PM 2.5

particles by 10 micrometer per cubic meter of air raises the death rate among heart patients by 20 percent. Smoking increases the risk for heart diseases, but air pollution can prove to be a bigger threat. Smokers develop a disease called Cor Pulmonale, and those in constant exposure to dust particles too may develop the disease. Cor Pulmonale is enlargement of the right ventricle of the heart as a response to increased resistance or high blood pressure in the lungs. There was increase in cases of the disease in Patna that may result in Chronic Obstructive Lung Disease (COPD) caused due to accumulation of pollutants in the lungs, the small blood vessels become very stiff and rigid. Many physicians have found a relationship between pollution, lung disorder and Cor Pulmonale.

### 2.2 Noise Pollution

Bihar has stride ahead in tackling the noise pollution from a casual approach to a scientific approach. Earlier, noise pollution level was monitored randomly, mainly during festivals. But, with setting up of continuous automatic monitoring stations noise level would be monitored. During Dussehra, BSPCB had monitored noise pollution level at 65 different locations in Patna for three days and all exceeded the specified level during Dussehra.

Patna is the eighth city in India and the first in the state where continuous noise monitoring stations are being installed. Currently, there are 35 such stations across seven cities, namely New Delhi, Mumbai, Lucknow, Kolkata, Bangalore, Hyderabad and Chennai. Five automatic ambient noise pollution monitoring stations would come up in the city to help Bihar State Pollution Control Board (BSPCB) keep a tab on the noise level in the state capital. A digital screen at these stations would automatically display the noise level and keep people informed about it. The checkpoints would be set up at Gandhi Maidan bus stand, Patliputra Industrial area, Patna City chowk, Indira Gandhi planetarium and Beltron Bhawan (Shashtri Nagar).

### 2.3 Water Pollution

According to the World Health Organization 900,000 Indians died each year from drinking contaminated water and breathing in polluted air. Water supply and sanitation in India was a matter of concern. The proportion of the population covered with access to safe water sources was 85 per cent, while the proportion of the population covered with access to improved sanitation was 52 per cent in 2001 (WHO, 2014).

Ensuring availability of safe drinking water for a large population always remained a most challenging occupation. Bihar in fact has been naturally gifted with a tremendous amount of underground water in almost every part of the state, excepting some hilly and hard to reach areas. The underground source of water used through hand pumps and considered relatively safer in comparison to well or ponds. The supply of underground water by municipalities in different towns gets polluted due to leakages and mixing up with drainage water. Therefore, water purifier became a most needed item in each household in every part of the state. However, in rural areas people still have not access of any water purifier and used traditional methods of water safety by boiling and filtering it before use. Several diseases could be prevented, lives saved, and expenditure on health may be minimized if drinking water is made safe in Bihar also being available in plenty. The underground water level usually goes down in several parts, especially during summer the period consumption of water used to be maximum causing tremendous hardships to people. In several parts of Bihar, underground water found having some permanent impurities like arsenic, high iron and other impurities that termed hazardous for health.

The arsenic and fluoride contamination of groundwater along with poor sanitation facilities in the state of Bihar has become a major challenge in water supply in rural and urban areas. Particularly the risk is high in rural areas because the affected aquifer (<70 m below ground) is the main supplier of drinking water mainly through hand pumps. The arsenic contamination confined within the Younger Alluvial Belt along the river Ganga. The affected areas are flood prone, geochemically representing reducing environment resulting in mobilization of arsenic in groundwater. The Pleistocene aquifers are free from arsenic contamination. However, a lot of water quality data generated, there is a lack of sufficient health data and their correlation with contamination. Presently the safe limit considered as 50 ppb. If the international guideline of 10 ppb is adopted the affected areas and the population at risk will be many times higher (D. S. Mishra, 2009).

The arsenic affected wells in particular and the contaminated aquifer in general required to avoid. Arsenic free deep aquifer with sufficient potentiality required to tap for community water supply. However, care required for leakage of contaminated water from the shallow aquifer downwards due to the faulty design / construction of the wells. Surface water may be the long-term sustainable source for the villages along the River Ganga. A detailed health data is an essential input for understanding the scale

of the problem, which is lacking. Research work is needed to study the impact on arsenic fixation and its magnification through the food chain. Arsenic treatment based solution may not be viable because of several constraints such as difficulty in operation, safe disposal of sludge and maintenance of the system. At last, efficient water, management required for preventing further deterioration of water quality and its sustainable use.

As per an estimate by the Government of Bihar almost 53.87 percent of the total population covered by water supply schemes out of those 30 percent covered by ground water sources. Total number of habitations in Bihar being 107640 and out of that number, habitations with 100 percent coverage was 76064, remaining partially covered. The rate of coverage in terms of SC, ST, Minority, and LWE Concentrated habitations were respectively 92.65, 93.75, 94.35, and 91.86 percent. It was estimated that 10587 habitations were affected by contamination of water of one or more kind of contaminations. Almost 1504, 727, 8355, and 1 were found contaminated by Fluoride, Arsenic, Iron, and Nitrate respectively.

Several schemes have been launched in Bihar and several habitations covered by those schemes such as PWSS, Hand pumps/ Bore wells, and others were respectively 4632, 90312, and 12696. Testing of drinking water performed in 21744 habitations.

Improved portable water supply and sanitation facilities and services are critical to enhance public health and improve human development outcomes, more so for rural households. Though the State of Bihar has recorded an impressive performance in providing safe drinking water to its rural households, further improvements required in terms of quantity, quality, equity, and sustainability. Further, it needed improved sanitation, especially for people living in rural areas. To address those issues in a coherent, concerted and urgent manner, new initiatives have been taken in a mission mode. New sustainable Water Supply & Sanitation schemes were executed in time-bound manner along with effective operation and maintenance. Community participation is also necessary in all stages starting from planning and execution of operation and maintenance of such schemes.

The Bihar State Water & Sanitation Mission (BSWSM) shall have the overall goal to improve the quality of life of rural citizens by enhancing access to improved and sustainable water supply and sanitation facilities and services in rural areas. It's expected to act as an autonomous body to implement, coordinate, and monitor implementation of activities/ projects relating to rural water supply, sanitation, solid, & liquid waste management and hygiene.

The Accelerated Rural Water Supply Program (ARWSP) introduced in 1972-73 by the Government of India to assist the States and Union Territories (UTs) to accelerate the pace of coverage of drinking water supply. The entire program started with a Mission approach with the launch of the Technology Mission on Drinking Water and Related Water Management in 1986. Later in 1999, Department of Drinking Water Supply formed to give more emphasis on the Rural Water Supply program.

A safety norm provided while implementing the Rural Water Supply Schemes, the norms adopted for providing potable drinking water to the population included availability of at least 40 liters per capita per day (lpcd) for humans. It included 3, 5, 15, 7, and 10 liters respectively, for Drinking, Cooking, Bathing, Washing utensils- House cleaning, and Ablution. In addition, a provision allowed at 30 lpcd for animals in hot and cold desert/ecosystems.

The Total Sanitation Campaign or TSC in Bihar has been launched to ensure sanitation facilities in rural areas with the broader goal to eradicate the practice of open defecation. TSC provided strong emphasis on key intervention areas such as Individual household latrines (IHHL), School Sanitation, and Hygiene Education (SSHE), Community Sanitary Complex, Aanganwadi toilets supported by Rural Sanitary Marts (RSMs), and Production Centers (PCs). Massive construction of toilets is under in different schools of Bihar under the National Swaksh Bharat Mission.

In Bihar there are almost over a dozen districts' are affected with arsenic however districts like Buxar, Bhojpur, Patna, and Bhagalpur where it is found to have a level of 1-2 mg per liter. It ranges between 0.1 to 1 mg per liter in district like Vaishalli and Samastipur. The menace of arsenic in water is complimented due to agriculture, use of biomass, and cow dung cakes for cooking. Earlier up to 1970 people were using ground water for drinking and now people rely over ground water through hand pumps more and more. Arsenic is the key reason for liver cancer, and other ailments in Bihar. Due to earth quakes arsenic mixing increases in rivers and underground water. There are iron contamination found in Bihar in different districts.

### 2.4 Soil Pollution in Bihar

Soil is one of the most important resources of a nation. It is the gift of nature of immense value. The most common use of the word soil is in the sense of a

medium in which plants grow, although it has a different connotation at different time and place, and for persons engaged in different professions. Almost all the economic activities are directly or indirectly dependent on soil. Thus soil is the backbone of agricultural and industrial development.

Soil has a number of characteristics, which may be regarded as the aggregate of the physical, chemical and biological properties. The Bihar plane consists of a thick alluvial mantle of drift origin overlying in most part. The siwalik and older tertiary rocks. The soil is mainly young loam rejuvenated every year by constant deposition of silt, clay and sand brought by different streams. This soil is deficient in phosphoric acid, nitrogen and humus, but potash and lime are usually present in sufficient quantity. There are three major types of soil in Bihar:

**Piedmont Swamp Soil** - found in northwestern part of west Champaran district.

**Terai Soil** – found in northern part of the state along the border of Nepal. The Gangetic Alluvium – the plain of Bihar is covered by Gangetic alluvium (both new as well as old).

The earth is surrounded by the air constituting the environment up to about 1600 kilometers from its surface. The atmosphere is a reservoir of several elements essential to life and it serves many purposes and functions. It contains lifesaving gases like oxygen for human beings and animals, and carbon dioxide for plants to perform the process of photosynthesis. As per a rough estimate it has 5× 1018 cubic meters of air and contains oxygen (21 percent), nitrogen (78 percent), carbon dioxide (0.3 percent), and hydrogen (0.7 percent) in a fixed proportion. However, anthropogenesis activities on the surface of the earth are causing an increase in the proportion of gases except O2 in our atmosphere, thereby polluting the air which is so precious for life. There are many types of causative agents called pollutants creating air pollution. The pollutants exert different types of visible and invisible biological effects. Hence, it is necessary to have an equal understanding of both environment and organisms. For our better living standards we need pure clean air, pure water, nutritious foods, clothes and space etc. which are the basic needs for life. But the quality of air and water is likely to deteriorate because of population explosion, rapid industrialization and urbanization.

Environmental pollution and human efforts for the betterment of living standards are the two sides of the same coin. In the wake of rapid industrialization, consequent urbanization and ever increasing population, the basic amenities of life, viz. air, water and land, are being populated continuously. Industrial complexes have become the focus of environmental pollution.

Air may be regarded as polluted when it is changed in its quality and composition as a result of human activities. The release of low amount of pollutants into the air does not lead to any serious effects because the atmosphere has a considerable absorptive capacity.

Various industrial installations such as asphalt plants, brick chimney plants, boiling and heating installations, cement manufacturing, fertilizer manufacturing, mineral acid manufacturing, paper and pulp manufacturing, thermal and nuclear power plants, sewage treatment plants, engineering workshops etc. form the stationary sources of the urban air pollution. The automobiles such as cars, scooters, motors, trucks and buses moving on the urban roads form the mobile sources of air pollution.

Saran district in North Bihar (INDIA) has various temporary as well as permanent brick chimney plants surrounding the district head quarter Chapra town. All the brick chimneys emit smoke rich in CO2, SO2 etc., which directly or indirectly interact with the constituents of the soil. The interaction of the dusty smoke with soil might bring about changes in physical as well as chemical nature of top layer of soil supporting plants. In continuation of our research on air-pollution and its effect on quality of soil the present research article deals the effect of air pollution on soil pH 5-9 of Saran district of Bihar (Singh, 2012) Radiation pollution: There are many sources that generate low levels of radiation and which basically remain unnoticed. It is estimated that about 20 percent of radiation we are exposed to be due to human activities. Cellular phones we use so frequently are a source of radiation. Cell phone towers, cordless phones, as well as TVs, computers, microwave ovens, broadcast antennas, military and aviation radars, satellites, and wireless internet are all sources of radiation. In addition, medical X-Rays, CT scan, and MRI are also sources of radiation. Considering this, the radiation pollution picture significantly increases. Radiation is essentially energy that travels and spreads out as it goes. This is referred to as electromagnetic radiation. Examples include: visible light, radio waves, microwaves, infrared and ultraviolet lights, X-rays, and gamma-rays. The differences between these various types of radiation consist in some physical properties such as energy, frequency, and wavelength. Thus, there are a variety of electromagnetic radiations. This means that any and all these types of radiation can generate radiation pollution if they are added by human

activities. However, the magnitude of the generated pollution varies, with higher-risk pollution generated by radiation of higher energy such as gamma-rays regardless of exposure time. This radiation is generated through detonation of nuclear weapons or in power plants. Therefore, the meaning of radiation pollution is that while there are ubiquitous sources of radiation, mostly the high-energy radiations cause radiation pollution with a serious health risk (such as cancer or death). This is why we will focus on sources for high-health risk radiation when discussing the radiation pollution causes and effects. However, the other types of radiation (in low doses over longer time) may still cause health problems including neurological, reproductive, and cardiac (Centre, 2015).

For better or worse people are exposed to a high amount of radiation as never before. Although the solar system is the largest supplier of the electromagnetic radiations or EMR however that has certain natural protection. The increasing number of mobiles, mobile towers, microwave ovens, Induction Cook tops, and other Electrical- Electronic items had virtually put our life at more risk as never before. Microwaves in facts comparatively considered safer than X-Rays and Gamma Rays. During a CT scan and MRI our body exposed to extremely dangerous high levels of radiation especially X-Rays. Several plastic products used in microwave cooking sold in market with declaration Microwave Safe however; they could not be termed fully safe. For decades, scientists and consumers debated over the possible effects of non-ionizing electromagnetic radiation on living tissue. Since it's very difficult to sort out the various risks we might get from fields emitted from power lines, cell phones, airplane flights, computers, clock radios, and of course microwave ovens. However, several studies have found strong fields raise cancer rates and other problems, but what about the cumulative effect of small exposure, or effects on children required more studies that are precise. Even microwave cooking could be risky due to leakage of radiation and it considered at least 2 feet distance from the source as safe. Several countries, as well as the International Electro technical Commission (IEC), the International Committee on Electromagnetic Safety (ICES) of the Institute of Electrical and Electronics Engineers (IEEE) and the European Committee for Electro technical Standardization (CENELEC), set a product emission limit of 50 watts per square meter (W/m2) at any point 5 cm away from the external surfaces of the oven. In practice, emissions from modern domestic microwave ovens substantially below this international limit, and interlocked that prevent people exposed to microwaves while the oven on. Moreover, exposure decreases rapidly with distance; e.g. a person 50 cm from the oven receives about one one-hundredth of the microwave exposure of a person 5 cm away. These product emission limits defined for the purpose of compliance testing, not specifically exposure protection. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) published guidelines on exposure limits for the whole EMF part of the spectrum. Exposure guidelines in the microwave range set at a level that prevents any known adverse health effect. Exposure limits for workers and for the public set well below levels where any hazardous heating occurs from microwave exposure. The emission limit for microwave ovens mentioned above consistent with the exposure limits recommended by ICNIRP (WHO, 2005). Thermal pollution:

Thermal pollution is the act of altering the temperature of a natural water body, which may be a river, lake or ocean environment. This condition chiefly arises from the waste heat generated by an industrial process such as certain power generation plants. The concept is most frequently discussed in the context of elevating natural water temperature, but may also be caused by the release of cooler water from the base of reservoirs into warmer rivers. Elevated river temperatures can also arise from deforestation or urbanization that can reduce stream shading. Thermal pollution is one parameter of the broader subject of water pollution. There can be significant environmental consequences of thermal pollution with respect to surface receiving waters such as rivers and lakes; in particular, decrease in biodiversity and creation of an environment hospitable to alien aquatic species may occur. Regulation of thermal pollution has been more elusive than for other forms of water pollution, although straightforward mitigation measures are available, especially in the case of elevated temperature discharges (Earth, 2015).

Early work on mathematical modeling of thermal pollution took place in the 1960s with works by Edinger, Geyer and Tichenor; the first hydrological treatments addressed the equilibrium geometry of a thermal plume, or iso-contour of elevated temperature within the receiving waters. These models considered the mixing of a stream of admixed differing temperature water into a natural water body. Slightly later more advanced models arose which allowed the analysis of thermal plumes across an extensive data base of historical meteorological statistics, so that the full impacts of thermal pollution could be considered in relation to diurnal, seasonal and climate change fluctuations. In any case the technology exists to forecast thermal contours in receiving waters for a proposed or hypothetical thermal source.

Given the demand for cooling in power generation and other industrial processes, the extent of thermal pollution worldwide is considerable, particularly in the industrialized countries of Europe, North America, Asia and Australia. For example in the United Kingdom, it is estimated that one half of all river flow is used for cooling purposes and hence leads to some elevated discharge of higher temperature water. As early as the 1980s in the USA thermal discharges amounted to one sixth of the total national river flow. In Australia, there are many instances of warm water discharge subsequent to cooling uses; however, cold water release downstream of reservoirs is at least as great a problem; for example, in New South Wales it is thought that up to 3000 river kilometers may be adversely affected by such Coldwater releases. The adverse effects of thermal pollution are often conjoined with other forms of water pollution such as chemical contamination or biological contamination, such that the combined effects of two or more pollution types can create severe stresses on aquatic ecosystems.

Waste heat discharged to natural waters typically depresses the dissolved oxygen content, affecting aquatic species such as fish. Amphibians and copepods. The resulting higher water temperature typically raises the metabolic rate of aquatic organisms; for example, increasing enzyme activity occurs, that causes plants and animals to take in greater quantities of nutrients and either carbon dioxide or oxygen. These metabolic changes can alter the balance of species composition, and may also lead to faunal migration, as species attempt to adapt to changed thermal conditions. As a result, original species may migrate away, and alien species may enter a local aquatic system. In some cases significant loss of biodiversity can arise, and in some instances total bio-productivity can increase at the expense of species declines. The most readily observable phenomenon is that of mass fish kills in a surface water body; in this case, there are often large numbers of dead fish seen floating in the water or washed up on the water banks. Juveniles or fish fry are particularly vulnerable to small changes in water temperature.

Many aquatic organisms are very sensitive to small temperature changes of as little as one degree Celsius; not only can the temperature change alter metabolic rates, but adverse changes in other cellular biological may arise, including reduction of cell wall permeability, harming osmotic processes; in addition, alteration of enzyme metabolism can be effected as well as coagulation of cell proteins. In many cases these cellular level impacts can affect reproductive success and even impact organism mortality. A large increase in temperature can lead to the denaturing of life-supporting enzymes by breaking down hydrogen and disulphide bonds within the quaternary structure of the enzymes. Decreased enzyme activity in aquatic organisms can cause problems such as the inability to break down lipids, which leads to malnutrition.

Primary producers are affected by thermal pollution since elevated water temperature increases aquatic plant growth rates, potentially resulting in a shorter lifespan and species overpopulation. This can cause an algae bloom which reduces the water's oxygen content in the water. The higher aquatic vegetative density leads to an increased plant respiration rate and also to a reduced underwater light intensity. The outcome is similar to the eutrophication that occurs when watercourses are polluted with leached agricultural inorganic fertilizers.

In the case of injection of cooler water from a reservoir into a warmer stream or river below, there can also be significant impacts upon fish, especially in the egg and larval stage; upon macro invertebrates and upon total aquatic productivity in the receiving river. These cold water forms of thermal pollution can also create a modified aquatic environment such that certain alien species may have a competitive advantage over native species.

There are several means of reducing impacts of warm water thermal discharges, including use of cooling ponds, cooling towers and also productive use of the heated water for a secondary industrial process or space heating. In the case of cold water discharge from reservoir bottoms, the mitigation is not as straightforward, and can often be very expensive. Since there are seasonal variations in the degree of vertical thermal stratification, the timing of water releases can sometimes be conducted to minimize cold water different in the discharge, provided these releases are consistent with needs for flood control or power generation. In the summer, for example, there may be extremes in formation of cold water layers at the reservoir bottom; such times would be adverse for cold water release impacts downstream.

## 3. CONCLUSION

Some countries and even individual states and provinces require limits on discharges that lead to thermal pollution of receiving waters. Although this aspect of water pollution has proven to be more elusive than conventional chemical discharge. In many cases regulation has come about through

judicial application of the United States Clean Water Act and other statutes. For example, in a state statute challenge the court found that anticipated thermal pollution impacts were sufficient grounds to reverse approval of construction of two nuclear power plants. Regulation may take very different approaches; in some laws, a best practice is required, such as the use of cooling ponds or cooling towers for waste heat discharge. In other cases, a numerical limit on acceptable temperature increase in the receiving waters is applied. For example, the World Bank standard provides a maximum increase of three degrees Celsius at the margin of the mixing zone.

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